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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/773,184	02/09/2004	Kia Silverbrook	MTB36US	8429

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EXAMINER	
FIDLER, SHELBY LEE	

ART UNIT	PAPER NUMBER
2861	

DATE MAILED: 07/18/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/773,184	SILVERBROOK, KIA	
	Examiner	Art Unit	
	Shelby Fidler	2861	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 May 2006*.

2a)☐ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-54* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-54* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *09 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *6/21/2006*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Allowable Subject Matter

The indicated allowability of claims 17, 36, and 53 is withdrawn in view of the newly discovered reference(s) to DeMoor et al. Rejections based on the newly cited reference(s) follow.

Specification

The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required: the terminology of the heating element being configured such that the energy required to be applied thereto to cause the ejection of a drop is less than the energy required to heat a volume of ejectable liquid equal to the volume of a drop, from a temperature equal to an ambient temperature to the boiling point is not disclosed in the specification.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 2, 4, 5, 6, 8, 10, 13, 14, 17, 19, 20, 22, 24, 25, 27, 29, 32, 33, 36, 38, 39, 41, 42, 43, 44, 46, 49, 50, and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US 6019457) in view of DeMoor et al.

Silverbrook teaches the following:

***regarding claims 1, 19, and 38**, an inkjet printhead (*col. 5, lines 60-61*) and printing system (*Figure 116*) comprising:

a plurality of nozzles (*col. 1, lines 64-65*), each defining a nozzle aperture having a central axis (*Z-axis, col. 2, lines 53-56*);

a bubble forming chamber corresponding to each of the nozzles respectively (*chamber 113, Figure 9*);

at least one heater element disposed in each of the bubble forming chambers respectively (*heater 120, Figure 9*), the heater element configured for thermal contact with a bubble forming liquid (*heater 120 in thermal contact with ink 106, Figure 12*); such that

heating a mass of solid material incorporated in the heater element to a temperature above the boiling point of the bubble forming liquid forms a gas bubble that causes the ejection of a drop of an ejectable liquid through the nozzle corresponding to that heater element (*col. 9, lines 26-28*); wherein,

the heater element is spaced from the central axis (*Z-axis through nozzle 445, Figure 13*) and defines a current path substantially around the central axis (*col. 9, lines 20-23 with Figure 13*)

***further regarding claim 38**, supplying the nozzle with a replacement volume of the ejectable liquid equivalent to the ejected drop (*col. 12, lines 59-61*)

***regarding claims 2, 20, and 39,** the bubble forming chamber has a circular cross section (*cavity 447, Figure 13*) and the heater element has arcuate sections that are concentric with the circular cross section (*heater elements 441 and 443, Figure 13*).

***regarding claims 4, 22, and 41,** the heater elements are ring-shaped (*heater elements 441 and 443, Figure 13*), and that they extend between electrodes mounted on opposite sides of the bubble forming chamber (*connections 442 and 443, Figure 13*).

***regarding claims 5, 24, and 42,** the bubble forming liquid and the ejectable liquid are of a common body of liquid (*col. 9, lines 26-30*).

***regarding claims 6, 25, and 43,** the printhead is configured to print on a page and to be a page-width printhead (*col. 2, lines 19-22*).

***regarding claims 8, 27, and 44,** each heater element is configured such that actuation energy of less than 500 nanojoules is required to be applied to that heater element to heat that heater element sufficiently to form a bubble in the bubble forming liquid thereby to cause the ejection of a drop (*col. 19, lines 8-10*)

***regarding claims 10, 29, and 46,** the printhead comprises a substrate having a substrate surface, wherein the areal density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square centimeter of substrate surface (*using the reference measurement of Figure 43 and counting the individual nozzles disclosed in the "part of cyan" section of Figure 43, calculations show that the density exceeds 10,000 per square cm:* $\frac{20 nozzles}{0.0016384 cm^2} = 12207 \frac{nozzles}{cm^2}$)

***regarding claims 13, 32, and 50,** a structure that is formed by chemical vapor deposition, the nozzles being incorporated on the structure (*col. 5, lines 47-49*)

***regarding claims 14, 33, and 49,** a structure which is less than 10 microns thick, the nozzles being incorporated on the structure (*col. 9, lines 8-10*)

***regarding claims 17, 36, and 53,** each heater element is configured to be heated to a temperature above the boiling point thereby to heat the part of the bubble forming liquid to a temperature above the boiling point to cause the ejection of a drop (*col. 9, lines 26-28*)

Silverbrook does not expressly teach the following:

***regarding claims 1, 19, and 38,** the heater element is less than 10 nanograms

***regarding claims 17, 36, and 53,** the heater element is less than two nanograms

DeMoor et al. teach the following:

***regarding claims 1, 17, 19, 36, 38, and 53,** the heater element is less than 2 nanograms (*page 285, Fabrication: Ti thickness = 5nm; TiN thickness = 30nm; heater width = 2000μm; heater width = 0.4μm. Therefore, the volume of Ti within the heater is $4*10^{-12}$ cm^3, and the volume of TiN within the heater is $2.4*10^{-11}$ cm^3. Using the known densities of Ti = 4.54 g/cm^3 and TiN = 5.22 g/cm^3, the heater element has an entire mass of 0.14344 ng*)

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize De Moor et al.'s heater element mass into the invention of Silverbrook. The motivation for doing so, as taught by De Moor et al., is that these heaters show excellent resistivity uniformity and a low TCR value (page 293, Conclusions).

Claims 3, 11, 21, 30, 40, and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US 6019457) as modified by DeMoor et al., as applied to claims 1, 19, and 38 and 2, 20, and 39 above, and further in view of Moon et al. (US 6761433 B2).

Silverbrook as modified by DeMoor et al. teach all claimed limitations except the following:

***regarding claims 3, 21, and 40,** the heater element is omega-shaped and extends between adjacent electrodes in the side of a bubble forming chamber

***regarding claims 11, 30, and 47,** each heater element has two opposite sides and is configured such that a gas bubble formed by the heater element is formed at both of the sides of the heater element

Moon et al. teach the following:

***regarding claim 3, 21, and 40,** the heater element is omega-shaped (*resistors 104, Figure 5A*) and extends between adjacent electrodes in the side of a bubble forming chamber (*col. 2, lines 34-37 read with electrodes 105, Figure 9*)

***regarding claims 11, 30, and 47,** each heater element has two opposite sides (*unreferenced elements, illustrated as black blocks, Figures 10-13*) and is configured such that a gas bubble formed by the heater element is formed at both of the sides of the heater element (*Figures 11-12*)

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize Moon's omega-shaped heaters into the invention of Silverbrook as modified by DeMoor et al. The motivation for doing so, as taught by Moon, is to provide another embodiment of a resistor that is spaced from the central axis of the nozzle (*col. 6, lines 4-8*).

Claims 7, 15, 16, 18, 26, 34, 35, 37, 51, 52, and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US 6019457) as modified by DeMoor et al., as applied to claims 1, 19, and 38 above, and further in view of Anagnostopoulos et al. (US 6502925 B2).

Silverbrook as modified by DeMoor et al. teach the following:

***regarding claims 15, 34, and 51,** a plurality of nozzle chambers each corresponding to a respective nozzle (*col. 7, lines 42-44*), a plurality of heater elements being disposed within each chamber (*col. 9, lines 20-23 with heaters 120, Figure 12 of Silverbrook*)

Silverbrook teaches all claim limitations except the following:

***regarding claims 7, 26,** the heater element is predominantly formed from titanium nitride

***regarding claims 15, 34, and 51,** the heater elements within each chamber being formed on different respective layers to one another

***regarding claims 16, 35, and 52,** each heater element is formed of solid material more than 90% of which, by atomic proportion, is constituted by at least one periodic element, having an atomic number below 50

***regarding claims 18, 37, and 54,** each heater element is covered by a conformal protective coating, the coating of each heater element having been applied substantially to all sides of the heater element simultaneously such that the coating is seamless

Anagnostopoulos et al. teaches the following:

***regarding claims 7, 26,** the heater element is predominantly formed from titanium nitride (*col. 10, lines 36-38*)

***regarding claims 15, 34, and 51,** the heater elements within each chamber being formed on different respective layers to one another (*col. 8, lines 36-38*)

***regarding claims 16, 35, and 52,** each heater element is formed of solid material more than 90% of which, by atomic proportion, is constituted by at least one periodic element, having an atomic number below 50 (*Ti and TiN, col. 10, lines 31-33*)

***regarding claims 18, 37, and 54,** each heater element is covered by a conformal protective coating, the coating of each heater element having been applied substantially to all sides of the heater element simultaneously such that the coating is seamless (*col. 10, lines 33-39 in combination with Figure 5*)

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a Titanium Nitride heater composition into the invention of Silverbrook as modified by DeMoor et al. The motivation for doing so, as taught by Chan (US 5870121), is to take advantage of TiN's highly stable and highly resistive characteristics (col. 5, lines 11-22).

Claims 9, 28, and 45 are rejected as best understood under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US 6019457) as modified by DeMoor et al., as applied to claims 1, 19, and 38 above, and further in view of Otsuka et al. (US 5485179).

Silverbrook as modified by DeMoor et al. teach all claimed limitations except for the following:

***regarding claims 9, 28, and 45,** the heater element is configured such that the energy required to be applied thereto to cause the ejection of a drop is less than the energy required to heat a volume of the ejectable liquid equal to the volume of the drop, from a temperature equal to the ambient temperature to the boiling point

Otsuka et al. teaches the following:

***regarding claims 9, 28, and 45,** the heater element is configured such that the energy required to be applied thereto to cause the ejection of a drop is less than the energy required to heat a volume of the ejectable liquid equal to the volume of the drop, from a temperature equal to the ambient temperature to the boiling point (*col. 13, lines 21-28 shows that the energy required*

to heat the heater is less when the ambient temperature is high, and more when the ambient temperature is low; therefore, Otsuka teaches that it would take less energy to eject a drop of ink than it would to heat ink from an ambient temperature to a boiling temperature).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize Otsuka's heating configuration into the invention of Silverbrook as modified by DeMoor et al. The motivation for doing so, as taught by Otsuka, is to control the temperature of the recording head based on the present ambient temperature (*col. 12, lines 41-49*).

Claims 12, 31, and 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US 6019457) as modified by DeMoor et al, as applied to claims 1, 19, and 38 above, and further in view of Campbell et al. (US 4870433).

Silverbrook as modified by DeMoor et al. teach all claimed limitations except for the following:

***regarding claims 12, 31, and 48**, the bubble which each element is configured to form is collapsible and has a point of collapse, and wherein each heater element is configured such that the point of collapse of a bubble formed thereby is spaced from that heater element

Campbell et al. teach the following:

***regarding claims 12, 31, and 48**, the bubble which each element is configured to form is collapsible and has a point of collapse, and wherein each heater element is configured such that the point of collapse of a bubble formed thereby is spaced from that heater element (*col. 3, lines 60-64*)

At the time of invention, it would have been obvious to a person of ordinary skill in the art to use the heater element design of Campbell et al. in the invention of Silverbrook as

modified by DeMoor et al. The motivation for doing so, as taught by Campbell, is to prevent cavitational damage to the heater elements (*col. 3, lines 14-23*).

Communication with the USPTO

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shelby Fidler whose telephone number is (571) 272-8455. The examiner can normally be reached on MWF 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vip Patel can be reached on (571) 272-2458. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

SF 7/10/06

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